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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER
UHLIR, NIKOLAS J

ART UNIT	PAPER NUMBER
1773	10

DATE MAILED: 03/20/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

AS-10

Office Action Summary	Application No.	Applicant(s)	
	09/781,975	HARKNESS ET AL.	
	Examiner	Art Unit	
	Nikolas J. Uhlir	1773	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 March 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,6-12,16-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) *none* is/are allowed.

6)☐ Claim(s) *1,2,6-12 and 16-20* is/are rejected.

7)☐ Claim(s) *none* is/are objected to.

8)☐ Claim(s) *none* are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

This office action is in response to the request for reconsideration dated 3/10/03. The applicant's in their response have established that US Patent 6146754 is valid only under 35 U.S.C 102(e) as prior art and was commonly owned with the instant application. Accordingly, this patent is not valid prior art as provided under 35 U.S.C 103(c). In light of this fact, the prior rejection dated 2/21/03 is withdrawn. In addition, the finality of the prior rejection is hereby withdrawn. The examiner sincerely apologizes for any undue burden this error has imparted to the applicant. A new action on the merits follows.

Claim Rejections - 35 USC § 103

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. Claims 1-2, 6-7, 9, 11-12, 16-17, and 19-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanahashi et al. (US6001447) in view of Suzuki et al. (US5143794) and Bertero et al. (US6150015).

3. Regarding the limitations of claim 1, wherein the applicant requires a magnetic recording medium comprising a substrate, a seedlayer on the substrate, a Cr containing first underlayer, a HCP underlayer, and a magnetic layer in this order, wherein a portion of the seedlayer is oxidized, the seedlayer comprises a Cr-X material, wherein X is selected from Al, Ca, Ti, V, Mn, Fe, Co, Ni, Zn, or a mixture thereof, and the solid solubility of X is at least 3 atomic % in chromium.

4. To be clear on the record, the examiner interprets the phrase "in this order" to be open language which requires that the position of the layers relative to one another be the order specified in the claim, but allows for additional layers to be present in the recording medium other then those specified. Further, the examiner interprets "HCP" to mean, "hexagonal close packed," as "HCP" is the industry accepted acronym for this crystal structure. Last, the examiner interprets "solid solubility of said X is at least 3 atomic % in Cr" to mean that at least 3 atomic % of X must be able to be dissolved/incorporated into Cr. More specifically, the examiner does not interpret this phrase to mean that more then 3 atomic % of X must be present. Thus, a CrTi film without a specific compositional ratio still reads on applicants claimed solid solubility ratio, as Ti is listed as a suitable X material having a solid solubility that is >3 atomic % in X.

5. With respect to claim 1, Tanahashi et al. (hereafter Tanahashi) teaches a magnetic recording medium that comprises a substrate, a Cr underlayer (71) formed on the substrate, a CrMo underlayer (72) formed on the Cr underlayer, a HCP CoCr underlayer (53) formed on the CrMo underlayer, and a CoCrPt magnetic layer formed on the CoCr underlayer (column 9, lines 13-30 and figure 7). It is the examiners position that the CrMo underlayer is equivalent to applicants claimed Cr containing first underlayer, and that the CoCr underlayer is equivalent to the applicants claimed HCP second underlayer. Further, it is the examiners position that the Cr layer is equivalent to a seed layer.

6. Tanahashi fails to teach the use of a Cr-X material as the seedlayer, wherein X has a solid solubility of at least 3 atomic % in Cr, X is selected from Al, Ca, Ti, V, Mn, Fe, Co, Ni, Zn, or a mixture thereof, and the Cr-X material is at least partially oxidized, as required by claim 1.

7. With respect to these deficiencies, it is noted that Bertero et al. (hereafter Bertero) teaches that the that when additional layers are deposited over a seedlayer, the grain size of the additional layers is controlled by the grain size and spacing of the underlayer, with lower grain size resulting in reduced noise (Column 14, lines 18-35).

8. Bearing the teachings of Bertero and Tanahashi in mind, Suzuki et al. (hereafter Suzuki) teaches a magnetic recording medium that comprises a Cr underlayer and a magnetic layer. Suzuki further teaches that the grain size of a Cr underlayer in a magnetic recording medium can be reduced by adding 0.1-10% of oxygen and 1-30 atomic % by weight of an element selected from the group consisting of Ti, Si, Ge, Cu, Pt, Ru, etc.... to the Cr layer. Last, Suzuki teaches that by reducing the grain size of the Cr layer, the noise of the media is reduced (column 12, lines 19-50).

9. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate 0.1-10 at.% of oxygen and 1-30 at. % of Ti into the Cr underlayer of Tanahashi.

10. One would have been motivated to make this modification due to the fact that the Cr underlayer of Tanahashi is effectively a seedlayer, in that all of the other layers in the media aside from the substrate are deposited above this layer. Further, Bertero teaches that reducing the grain size can reduce the media noise of a recording media. Suzuki

provides a means for reducing the grain size of a Cr underlayer by adding O and elements including Ti to the layer, and iterates that by doing so the grain size of the magnetic layer and the media noise are both reduced. Regarding the specific selection of titanium from the list of elements in Suzuki, one would have been motivated to select Ti from this list as it is taught to be equivalent to the other materials listed as suitable for being added to a Cr layer for the purpose of reducing the grain size of the layer. The applicant is respectfully reminded that substitution of equivalents requires no express motivation as long as the prior art recognizes the equivalency. *In Re Fount* 213 USPQ 532 (CCPA 1982); *In Re Siebentritt* 152 USPQ 618 (CCPA 1967); *Grover Tank & Mfg. Co. Inc V. Linde Air Products Co.* 85 USPQ 328 (USSC 1950).

11. Regarding the limitation in claim 1 as to the solid solubility of X in Cr. The examiner takes the position that the solid solubility of one material in another is a material property. Thus, when a CrTi layer is utilized as the seedlayer, the examiner takes the position that the limitation in claim 1 requiring X to have a solid solubility of at least 3 at. % in Cr is met, as Ti is listed in the instant application as a suitable X material having the required solid solubility.

12. Regarding the limitations of claim 2, wherein the applicant requires the lattice tuning capability of X to be at least 2% that of Cr. To be clear on the record, the examiner interprets this limitation to require that the X material be able to adjust one or more lattice parameters of a Cr crystal by at least 2%, as is commensurate with the description of this property provided in the instant specification (page 8-9, lines 20-1). The examiner takes the position that the lattice tuning capability of a material is a

material property. Thus, when Ti is added to the Cr underlayer utilized in Tanahashi, thus forming a CrTi underlayer, the limitations of claim 2 are necessarily met, as Ti is listed as an X materials possessing the required property in the instant specification.

13. Regarding the limitations of claim 6, wherein the applicant requires that the oxidized portion of the seedlayer contain between 0.0001-20 atomic % oxygen. Suzuki teaches that the addition of 0.1-10% O to a Cr underlayer is sufficient to reduce the grain size of the layer, as stated above for claim 1. Thus, as 0.1-10 at % is completely encompassed in the range recited for claim 6, this limitation is met.

14. Regarding claim 7, wherein the applicant requires the Cr-X seedlayer to contain 0.01-0.9 at % O. Although this specific range is not explicitly taught by Tanahashi, Bertero, or Suzuki, Suzuki teaches that adding oxygen to Cr alloy underlayers impacts the grain size of the underlayer (column 12, lines 19-27). More specifically, the magnetic grains are made finer with increasing amounts of oxygen resulting in decreased grain size (column 5 lines 20-25). Thus, the examiner takes the position that the amount of oxygen added to the Cr underlayer of Tanahashi is a results effective variable. It would have been obvious to one of ordinary skill in the art at the time the invention was made to adjust the concentration of oxygen in the seedlayer to achieve a desired grain size in both the seedlayer and the magnetic layer formed above the seedlayer. Further, it would have been obvious to one of ordinary skill in the art at the time the invention was made to adjust the grain size of the seedlayer to a desired value to achieve a desired level of noise in the magnetic recording medium.

15. Regarding claims 9 and 19, wherein the applicant requires that a magnetic recording media comprising a Cr-X underlayer and a CoCr containing underlayer to form a first magnetic medium exhibit a stronger (110) peak by X-ray crystallography than that of a second magnetic recording medium that comprises a Cr underlayer and a CoCr containing underlayer. The examiner takes the position that the strength of an X-ray crystallography peak is a material property. Thus, as the combination of Tanahashi with Suzuki and Bertero results in a material having the same structure and is formed from the same materials as disclosed by the applicant in both the specification and the claims, this limitation is met.

16. Regarding claim 11, wherein the applicant requires a method for forming a magnetic recording medium that has identical characteristics to that of claim 1. The method limitations of claim 11 are nominal, requiring only that the requisite layers be "formed" in the required order. As the combination of Tanahashi with Suzuki and Bertero above will necessarily require the layers to be "formed" in the required order, this limitation is met by the combination as set forth above for claim 1.

17. Regarding claim 12, wherein the applicant requires the method of claim 11, wherein the heat of oxide formation of X is less then that of Cr and that the lattice tuning capability of X is at least 2% that of Cr. These limitations are met as set forth above for claim 11, as the combination of Tanahashi with Suzuki and Bertero results in a CrTi seedlayer being utilized, and Ti is specifically listed in the instant specification as a suitable X material having a lattice tuning capability of 2% that of Cr and a lower heat of oxide formation then that of Cr.

18. Regarding the limitations of claim 16, wherein the applicant the method of claim 11, and further requires the oxidized portion of the seedlayer to contain 0.1-0.9 atomic % oxygen. This limitation is met as set forth above for claims 7 and 11.

19. Regarding the limitations of claim 17, wherein the applicant requires the mean grain size of the magnetic layer to be ≤10nm. As stated above for claim 7, Suzuki teaches that adding oxygen to Cr alloy underlayers impacts the grain size of the underlayer (column 12, lines 19-27). More specifically, the magnetic grains are made finer with increasing amounts of oxygen resulting in decreased grain size (column 5 lines 20-25). Thus, the examiner takes the position that the amount of oxygen added to the Cr layer of Tanahashi is a results effective variable, and it would have been obvious to one of ordinary skill in the art to adjust the concentration of oxygen in the seedlayer to achieve a desired grain size in both the seedlayer and the magnetic layer formed above the seedlayer. Further, it would have been obvious to one of ordinary skill in the art at the time the invention was made to adjust the grain size of the seedlayer to a desired value to achieve a desired level of noise in the magnetic recording medium.

20. With respect to claim 19, wherein the applicant requires a generic method for forming a recording medium that has identical characteristics to the medium described in claim 9. These limitations are met as set forth above for claim 9, as no substantial method limitations are recited in claim 19 that would result in the resulting article having a different structure then that of the medium described in claim 9.

21. With respect to claim 20, wherein the applicant requires a magnetic recording medium comprising a means for low noise recording, a magnetic layer, an underlayer

comprising a Cr containing material, and a layer for allowing a BCC-HCP transition to occur between the underlayer and the magnetic layer. To be clear on the record, the examiner interprets the required "means for low noise recording" to require that a Cr-X layer is utilized, wherein X has a solid solubility of at least 3 atomic % in Cr, said X having a heat of oxide formation of >200kcal/mol **or** a lattice tuning capability of at least 2% that of Cr, as is commensurate with the definition provided for this phrase on pages 6-7 of the instant specification.

22. The combination of Tanahashi with Suzuki and Bertero results in recording medium having a substrate, an oxidized CrTi seedlayer, a Cr alloy 1st underlayer, a CoCr 2nd underlayer on the 1st underlayer, and a magnetic layer on the CoCr layer. As is shown by Tanahashi, the CoCr layer provides the required transition from a bcc to hcp crystal structure (column 12, lines 36-67 and column 13, lines 1-29). Further, when CrTi is utilized as the seedlayer, the limitation of a "means for low noise recording" is met, as Ti listed in the instant specification as suitable X materials that have a lattice tuning capability of 2% that of Cr and a solid solubility fo at least 3 atomic % in Cr. Thus, the limitations of claim 20 are met by the combination of Tanahashi with Suzuki and Bertero.

23. Claims 8, 10, and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanahashi as mdified by Bertero and Suzuki as applied to claims 1 and 11 above, and further in view of Ivett et al. (US US5298324).

24. Tanahashi as modified by Suzuki and Bertero does not teach a magnetic recording medium utilizing a Cr-X seedlayer that is Cr-10W, and and a CoCr 2nd

underlayer that is Co-37Cr, as required by claim 10. Further, Tanahashi as modified by Suzuki and Bertero does not teach a Cr-X seedlayer or a method for making a Cr-X layer, wherein the Cr-X seedlayer has a (110) inter-planar spacing that is roughly equivalent to the (0002) inter-planar spacing of a HCP alloy within a CoCr containing underlayer or a magnetic layer deposed on top of the seed layer, as required by claims 8 and 18.

25. With respect to the use of a W containing Cr underlayer, it is noted that Suzuki teaches the equivalence of Cr-W to CrTi as materials suitable for use in underlayers of recording media (column 17 example 1).

26. Therefore it would have been obvious to one of ordinary skill in the art to utilize CrW as taught by Suzuki as the seedlayer in Tanahashi, as CrW is taught to be equivalent to CrTi as an underlayer material for reducing the grain size of a recording medium. Applicants are referred to the citation in paragraph 11 above which establish that substitution of equivalents requires no express motivation as long as the prior art recognizes the equivalents.

27. With respect to the amount of Cr in the CoCr containing underlayer, Tanahashi et al. teaches that for the purpose of lattice matching with the magnetic layer, the CoCr hcp layer should preferably contain between 26-50 atomic % Cr. When the amount of Cr drops below 26%, the hcp is magnetic and affects the magnetic properties of the magnetic layer formed on top of it. Conversely, if the amount of Cr exceeds 50%, the hcp layer cannot exhibit good crystalline structure (Column 4, lines 16-27). Thus, the examiner takes the position that the amount of Cr in the CoCr layer is a results effective

variable, and it would have been obvious to one with ordinary skill in the art at the time the invention was made to vary the amount of Cr in the hcp layer to optimize the lattice matching of the CoCr layer with the magnetic layer, while simultaneously avoiding the drawbacks of too little or too much chromium.

28. With respect to the amount of W in the Cr-W seedlayer, Ivett et al. teaches a magnetic recording medium comprising a substrate, an underlayer comprised of Cr-W, and a Co based magnetic layer (column 3, lines 30-35). The Cr-W layer typically comprises 85-99 atomic % Cr (1-15 atomic % W). The amount of W used is chosen so as to achieve lattice matching between the Cr-W layer and a Co based layer deposited on top of the Cr-W layer (column 4, lines 64-68). As the atomic size of Cr and Co is roughly the same, the lattice matching is achieved due to the large atomic radius of W as compared to Cr and Co (column 5, lines 55-64). Thus, the examiner takes the position that the amount of tungsten is a results effective variable. The addition of more tungsten will result in greater expansion of the Cr lattice then the addition of less tungsten. Thus, it would have been obvious to one with ordinary skill in the art at the time the invention was made to optimize the amount of tungsten used in the Cr-W underlayer in order match the lattice spacing of the underlayer to a Co based layer deposited on top of the Cr-W layer. Magnetic media that have a Cr-W underlayer that is lattice matched with the Co based alloy layer deposited above the Cr-W layer exhibit no reduction in coercivity as the thickness of the underlayer is increased, thus the thickness of the underlayer need not be tightly controlled as was required by other conventional underlayers (column 6, line 62-column 7, line 9).

29. Therefore it would have been obvious to one with ordinary skill in the art at the time the invention was made to vary the content of W and Cr in the Cr-W and CoCr underlayers taught by Tanahashi as modified by Suzuki and Bertero in order optimize the lattice match between the underlayer/seedlayer and the magnetic layer.

30. One would have been motivated to make these modifications due to the teaching in Tanahashi et al. that the amount of Cr in the CoCr layer impacts the lattice structure of the CoCr layer, and the teachings in Ivett et al. that the amount of W added to a Cr-W underlayer impacts the lattice structure of the Cr-W layer and that magnetic recording media having a Cr-W seedlayer that is lattice matched to a Co based layer deposited on the Cr-W layer exhibit no reduction in coercivity as a function of the seedlayer thickness.

31. Regarding claims 8 and 18, although neither Tanahashi, Suzuki, Bertero, or Ivette explicitly teach optimizing the (110) spacing of the Cr-X material to the (0002) inter-planar spacing of a HCP alloy within the CoCr underlayer or the magnetic layer, the examiner takes the position that it would have been obvious to one of ordinary skill in the art at the time the invention was made to match **any** lattice spacing of the seedlayer to **any** lattice spacing of either an underlayer or magnetic deposed above the seedlayer. One would have been motivated to due so due to the teaching in Ivette et al. that a magnetic recording media that has a seedlayer that is lattice matched to an underlayer exhibits no reduction in coercivity as a function of the seedlayer thickness.

Response to Arguments

32. Applicant's arguments filed 12/13/02 have been fully considered but they are not persuasive. Although applicant's arguments are moot in view of the new grounds of

rejection, the examiner feels it would be beneficial to discuss some of the applicant's arguments, particularly those related to unexpected results.

33. The applicant has presented the argument that the applicant unexpectedly discovered that the presence of a non-oxidized Cr containing layer between an oxidized Cr alloy seedlayer and an HCP underlayer prevents the diffusion of oxygen from the oxidized seedlayer to the HCP layer, thereby preventing the oxidation of the bcc-hcp interface, while simultaneously increasing the number of nucleation sites on the seedlayer. While the examiner does not refute that the finding that the non oxidized layer prevents oxidation may have been unexpected, it has not yet been established that the prior art structure resulting from the combination of Song with Tanahashi would not have been obvious to one of ordinary skill in the art, and would not exhibit the applicants argued benefit.

34. It is true that neither Tanahashi, Bertero, Suzuki and Ivette address the issue of bcc-hcp interface oxidation, which is the motivation behind the instant application. However, there is clear motivation in the cited prior art to form a structure that is substantially similar or identical to the instantly claimed invention. Without a clear showing that the combination of the prior art does not necessarily result in the applicant's unexpected result, this argument is unpersuasive.

35. The examiner further recognizes that references may only be combined when there is some teaching or motivation to one of ordinary skill in the art to do so. In the instant case, it the examiners position that the Cr underlayer of Tanahashi is a seedlayer, as all of the other layers in the medium are formed over its surface. As

shown by Bertero and Suzuki, the grain size of a seedlayer in a recording medium impacts the grain size of layers deposited above the seedlayer, with lower grain size resulting in lower noise. Suzuki clearly teaches a method for reducing the grain size of a Cr layer, that method being the addition of oxygen and an element such as Ti to the layer, with the result being reduced grain size and reduced noise. Thus, in view of these teachings, while the prior art does not address the oxidation problem that is asserted by the applicant, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form a magnetic media having the applicants claimed structure, with an expectation of success.

36. Applicants are reminded that it has been held that the fact that an applicant has recognized another advantage that would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985). The examiner maintains that in light of the teachings of Tanahashi, Suzuki, Bertero, and Ivett, the formation of a magnetic media having the structure and composition required by the applicant in the instant claims would have been obvious to one of ordinary skill in the art, albeit for different reasons then those addressed by the applicant.

Examiners Note

37. The reference cited in this office action accompanied a prior office action, and so are not included with this action.

Conclusion

38. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nikolas J. Uhlir whose telephone number is 703-305-0179. The examiner can normally be reached on Mon-Fri 7:30 am - 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Thibodeau can be reached on 703-308-2367. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-0389.

nju
March 18, 2003

Paul Thibodeau
Supervisory Patent Examiner
Technology Center 1700